

### Trend Study 28-7-03

Study site name: Paragonah.

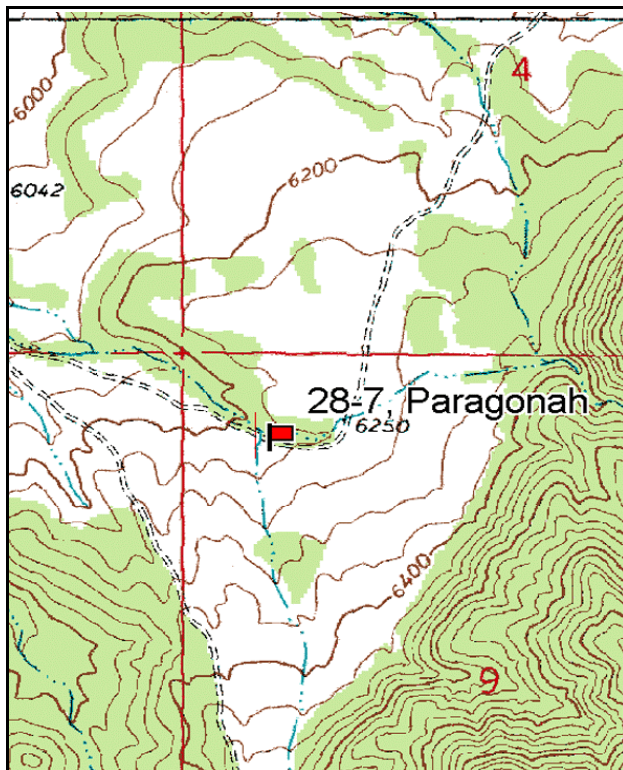
Vegetation type: Chained, Seeded P-J.

Compass bearing: frequency baseline 132 degrees magnetic.

Frequency belt placement: line 1 (11 & 71ft), line 2 (34ft), line 3 (59ft), line 4 (95ft).

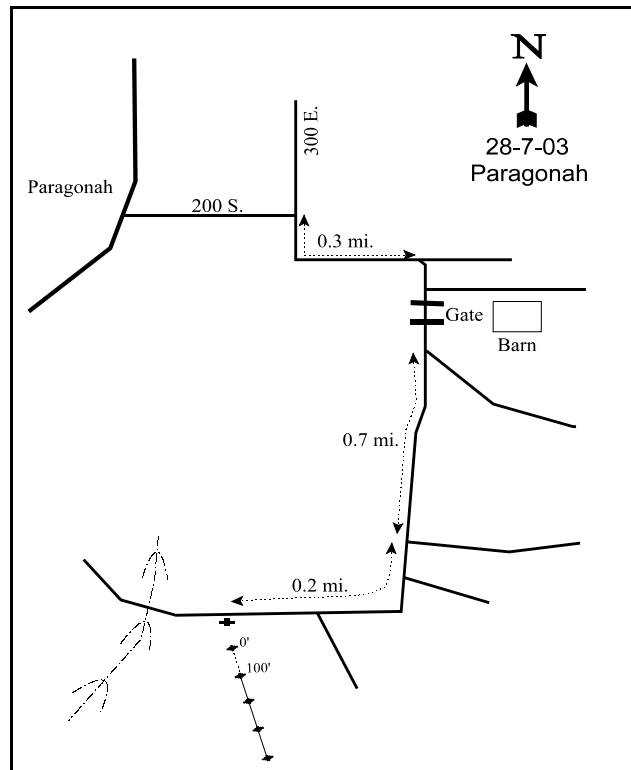
### LOCATION DESCRIPTION

From 200 South and 300 East in Paragonah, continue south on 300 East for 0.3 miles to where the road turns south. Drive 0.1 miles to a gate and a barn. Go through a series of two gates and to a fork. Stay right on the road that goes south and drive for 0.7 miles to another fork. Continue south for 0.2 miles (the road will bend and go west) to the witness post on the south (left) side of the road (just beyond the witness post is a large gully). The baseline starts 92 feet at 188 degrees magnetic from the witness post. The study is marked by short fenceposts.



Map Name: Parowan

Township 34S, Range 8W, Section 9



Diagrammatic Sketch

GPS: NAD 27, UTM 12S 4192156 N, 344157 E

## DISCUSSION

### Paragonah - Trend Study No. 28-7

This study is located in an old chained and seeded pinyon-juniper area on critical winter range for deer. The site slopes to the northwest at 10% and elevation is 6,200 feet. The site slopes away from the cliffs and towards the fields at the base of the bench. There was considerable regrowth of pinyon and juniper on this site until a hand thinning treatment was done prior to the 2003 survey. A pellet group transect read on site in 1998 and 2003 estimated about 23 deer days use/acre (58 ddu/ha) during both readings.

Soil textural and chemical analysis indicates a sandy loam with a slightly acidic pH (6.3). Rock and pavement are scattered throughout the site on the soil surface and throughout the soil profile. The average effective rooting depth is almost 11 inches with a rocky horizon encountered at a depth of 6 to 8 inches. Chemical analysis measured phosphorus at 6.0 ppm and potassium at 3.2 ppm, both of which could limit plant development. Ten ppm of phosphorus and 70 ppm of potassium are thought necessary for normal plant growth and development. Bare areas continue to be subjected to sheet erosion and runoff has formed various sized gullies throughout the site. Some soil movement was noticeable in 1992 and 1998, and several old gullies have been noted to exist on the site. Vegetation and litter cover left from the chaining process help to stabilize the soil. Vegetation cover was very low in 2003 with drought conditions and the hand thinning treatment which effectively removed most of the pinyon and juniper trees on the site. Litter cover was high in 2003 at an estimated 57%. An erosion condition class assessment rated soils as stable in 2003.

Eleven species of shrubs or trees have been sampled on the site in at least 1 year, but only black sagebrush, broom snakeweed, and Gambel oak are abundant. Black sagebrush is the key browse species with an estimated density of 2,540 plants/acre in 1998, and 2,960 in 2003. These estimates are somewhat lower than the 1987 and 1992 estimates which averaged about 4,000 plants/acre. Utilization on black sagebrush was heavy in 1987 when 76% of the shrubs displayed heavy use. Use declined to a more moderate level in 1992, and was mostly light in 1998 and 2003. Vigor has been mostly normal in all readings with 11% of the population displaying poor vigor in 2003. The black sagebrush population has steadily become more mature and decadent with every reading. Seedling and young plants were moderately abundant from 1987-1998, but few were sampled in 2003 which is expected with drought conditions. Percent decadence was low to moderate between 1987-1998 (7-29%), but increased to 43% in 2003. The increase in decadence in 2003 is also not surprising with the drought experienced prior to and including the 2003 sampling year. Black sagebrush leaders had averaged 1.6 inches of growth when the site was read in June 2003. Small numbers of mountain big sagebrush also occur on the site, and some of the black sagebrush are hybrids with mountain big sagebrush.

Broom snakeweed was the most abundant shrub during the initial reading in 1987 at an estimated 7,932 plants/acre. Density declined to 4,320 plants/acre in 1992, 1,320 in 1998, and 2,560 in 2003. A significant portion of the population has been made up of young plants since 1992. The Gambel oak on the site occurs in large scattered clones. Density was estimated at 2,160 stems/acre in 2003. Oak has shown mostly light use in all surveys and is used primarily for cover by wintering animals. Canopy cover of oak was estimated at about 6% in both 1998 and 2003. Pinyon and juniper, although not numerous, figured prominently in the vegetative structure of this site prior to the hand thinning treatment. Point-center quarter data in 1998 estimated 49 Utah juniper trees/acre and 71 pinyon pine trees/acre for a total of 120 trees/acre. Most of the trees were in the 4 to 8 foot category. Pinyon-juniper canopy cover was estimated at 23% in 1998. Following the hand thinning treatment, pinyon-juniper canopy cover was reduced to less than 1% in 2003.

The herbaceous understory is dominated by a patchy stand of crested and intermediate wheatgrasses. Nested frequency for both of these species declined significantly in 1992. Intermediate wheatgrass nested frequency significantly increased in 1998 while crested wheatgrass remained stable. Both species significantly declined

in 2003. Cheatgrass significantly increased in 1998, but also declined in 2003 with drought conditions. Perennial forbs are diverse but are rarely encountered. The only common forb encountered during any year was the prostrate fendler spurge. Perennial forb sum of nested frequency has decreased with each reading since 1992. Annual forbs increased in 2003 due primarily to bur buttercup.

#### 1987 APPARENT TREND ASSESSMENT

The percentage of erosion pavement covering the ground surface is very high (27%). Rocks are also common. Where shrubs and grasses occur, litter has accumulated providing excellent soil protection. However, plants are scattered, and consequently, the percent cover provided by vegetation and litter is only 46%. Bare soil is exposed on 15% of the ground surface and there is plenty of evidence of soil loss. Most erosion took place gradually over time and likely prior to the chaining treatment. The preferred browse species, black sagebrush, and mountain big sagebrush, have been heavily hedged but display good vigor with an adequate amount of seedlings and young. The abundance of broom snakeweed is a negative factor that should be closely monitored.

#### 1992 TREND ASSESSMENT

Looking at the data and photos, it appears that herbaceous ground cover has declined slightly while bare ground has increased. Most open areas are still covered by a nearly continuous layer of rock and pavement. Even though some soil movement is detectable, erosion is not presently a problem on this site, but the potential is still present especially if there is further loss of the herbaceous understory. Trend for soil is down slightly. The key browse on the site consist of black sagebrush, mountain big sagebrush, and oak. Trend for all these species is stable with increased densities, good vigor, and less heavy hedging, but increased decadence for black sagebrush which makes up the majority of the preferred browse. Broom snakeweed also declined significantly. The only negative factor is the increase in pinyon and juniper trees which are regaining dominance of the site. The herbaceous component consists primarily of 2 seeded grasses which declined in nested and quadrat frequencies since the last reading. The increase in the summed nested frequencies of forbs is likely the result of the increased sample size which picked up an additional 6 perennial forbs. Grass and forb summed nested frequencies combined declined since 1987 indicating a downward trend.

#### TREND ASSESSMENT

soil - slightly down (2)

browse - stable (3)

herbaceous understory - down (1)

#### 1998 TREND ASSESSMENT

The soil trend is upward with an increase in percent vegetation and litter cover and a decrease in percent bare ground. Erosion potential has decreased with an increase in protective ground cover. Some slight soil erosion is apparent, but not excessive. The browse trend is slightly down. Utilization is currently light with the percentage of plants in poor vigor remaining low over all years. However, the population of black sagebrush has decreased by 41% and the number of seedling and young plants are not adequate to replace the plants being lost from the population. The herbaceous understory trend is stable with a slight increase in perennial herbaceous understory sum of nested frequency. Cheatgrass sum of nested frequency increased significantly since 1992 and currently accounts for 27% of the total herbaceous understory cover. Crested wheatgrass and intermediate wheatgrass are the dominate perennial species contributing 55% of the herbaceous understory cover combined.

### TREND ASSESSMENT

soil - up (5)

browse - slightly down (2)

herbaceous understory - stable (3)

### 2003 TREND ASSESSMENT

Trend for soil is stable even with a large decline in vegetation cover. The majority of the decline in vegetation is due to the hand thinning treatment which effectively eliminated most of the pinyon and juniper trees from the site. Drought conditions also resulted in very little herbaceous cover in 2003. Even with less vegetation cover, litter cover increased and erosion remains low. The ratio of protective cover to bare ground remained unchanged. Trend for browse is slightly down. Black sagebrush has a higher density estimate, but shows increases in percent decadence and poor vigor, and a decrease in the number of young plants in the population. The number of decadent, dying plants in the population is more than double the number of young which may result in a population decline by the next reading. Although not as abundant as black sagebrush, mountain big sagebrush is important on this winter range. In 2003, mountain big sagebrush decadence increased to 67%, no young were sampled, and 1/3 of the population displayed poor vigor. The pinyon-juniper thinning treatment should help both sagebrush species as well as the herbaceous understory. Trend for the herbaceous understory is down. Sum of nested frequency of perennial grasses and forbs have declined by nearly half since 1998, and the 2 most prominent grasses, crested wheatgrass and intermediate wheatgrass, both significantly declined in nested frequency and cover individually.

### TREND ASSESSMENT

soil - stable (3)

browse - slightly down (2)

herbaceous understory - down (1)

### HERBACEOUS TRENDS --

Management unit 28 , Study no: 7

Type	Species	Nested Frequency				Average Cover %		
		'87	'92	'98	'03	'92	'98	'03
G	Agropyron cristatum	c211	b146	bc154	a90	3.39	4.71	.71
G	Agropyron intermedium	b58	a27	b59	a13	.49	2.13	.05
G	Agropyron smithii	-	-	11	-	-	.02	-
G	Bromus tectorum (a)	-	a45	c219	b91	.33	3.40	.33
G	Oryzopsis hymenoides	10	8	5	1	.07	.18	.15
G	Poa secunda	a2	a3	b24	b21	.00	.19	.12
G	Sitanion hystrix	b13	a-	ab7	a4	.00	.19	.01
G	Stipa comata	-	-	3	-	-	.00	-
G	Vulpia octoflora (a)	-	a-	a-	b12	-	-	.03
Total for Annual Grasses		0	45	219	103	0.32	3.40	0.36
Total for Perennial Grasses		294	184	263	129	3.97	7.46	1.04
Total for Grasses		294	229	482	232	4.30	10.87	1.40

Type	Species	Nested Frequency				Average Cover %		
		'87	'92	'98	'03	'92	'98	'03
F	Alyssum alyssoides (a)	-	3	7	10	.00	.02	.02
F	Arabis spp.	-	3	-	-	.00	-	-
F	Artemisia dracunculus	-	-	4	-	-	.03	-
F	Astragalus lentiginosus	-	2	-	-	.01	-	-
F	Astragalus newberryi	1	4	3	-	.01	.01	-
F	Collinsia parviflora (a)	-	-	-	5	-	-	.01
F	Delphinium nuttallianum	-	-	-	2	-	-	.00
F	Draba spp. (a)	-	-	-	7	-	-	.02
F	Eriogonum cernuum (a)	-	2	-	-	.00	-	-
F	Erigeron pumilus	<sub>b</sub> 10	<sub>ab</sub> 10	<sub>a</sub> 4	<sub>a</sub> -	.04	.01	-
F	Eriogonum racemosum	-	1	-	3	.00	-	.00
F	Eriogonum umbellatum	5	1	3	3	.03	.01	.00
F	Euphorbia fendleri	<sub>b</sub> 80	<sub>ab</sub> 75	<sub>ab</sub> 55	<sub>a</sub> 40	1.12	.88	.40
F	Lactuca serriola	-	1	6	-	.00	.02	-
F	Leucelene ericoides	<sub>a</sub> -	<sub>b</sub> 12	<sub>ab</sub> 8	<sub>b</sub> 15	.22	.30	.36
F	Lithospermum ruderales	<sub>a</sub> -	<sub>b</sub> 13	<sub>a</sub> 2	<sub>a</sub> 3	.06	.15	.01
F	Machaeranthera canescens	3	3	-	-	.03	-	-
F	Microsteris gracilis (a)	-	-	-	4	-	-	.01
F	Penstemon eatoni	-	-	-	-	-	.00	-
F	Petroradia pumila	1	-	-	-	-	-	-
F	Phlox longifolia	-	-	7	6	-	.01	.01
F	Ranunculus testiculatus (a)	-	<sub>a</sub> 18	<sub>a</sub> 7	<sub>b</sub> 98	.09	.02	.74
F	Senecio douglasii	2	-	-	-	-	-	-
F	Sphaeralcea coccinea	-	10	2	1	.19	.03	.03
F	Streptanthus cordatus	3	9	10	9	.31	.09	.02
F	Tragopogon dubius	1	-	-	-	-	-	-
F	Unknown forb-perennial	24	-	-	-	-	-	-
Total for Annual Forbs		0	23	14	124	0.09	0.04	0.80
Total for Perennial Forbs		130	144	104	82	2.05	1.57	0.85
Total for Forbs		130	167	118	206	2.15	1.61	1.66

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS --

Management unit 28 , Study no: 7

Type	Species	Strip Frequency			Average Cover %		
		'92	'98	'03	'92	'98	'03
B	Artemisia nova	59	50	47	4.31	5.88	3.88
B	Artemisia tridentata vaseyana	7	8	3	.03	.15	-
B	Brickellia spp.	1	0	0	-	-	-
B	Chrysanthamnus nauseosus	1	2	0	.00	-	-
B	Eriogonum microthecum	12	4	2	1.05	.07	.03
B	Gutierrezia sarothrae	49	30	43	1.46	.79	1.07
B	Juniperus osteosperma	4	2	0	1.92	1.25	-
B	Leptodactylon pungens	11	7	5	.27	.39	.15
B	Opuntia spp.	2	2	1	.03	.04	.15
B	Pinus edulis	13	14	0	8.71	9.66	.39
B	Quercus gambelii	8	7	9	4.50	4.65	3.42
Total for Browse		167	126	110	22.31	22.91	9.11

CANOPY COVER, LINE INTERCEPT --

Management unit 28 , Study no: 7

Species	Percent Cover	
	'98	'03
Artemisia nova	-	3.26
Gutierrezia sarothrae	-	.61
Juniperus osteosperma	4.19	.40
Leptodactylon pungens	-	.03
Pinus edulis	18.60	.50
Quercus gambelii	6.00	5.31

KEY BROWSE ANNUAL LEADER GROWTH --

Management unit 28 , Study no: 7

Species	Average leader growth (in)
	'03
Artemisia nova	1.6

# POINT-QUARTER TREE DATA --

Management unit 28 , Study no: 7

Species	Trees per Acre	
	'98	'03
Juniperus osteosperma	49	-
Pinus edulis	71	18

Average diameter (in)	
'98	'03
4.7	-
5.1	1.0

# BASIC COVER --

Management unit 28 , Study no: 7

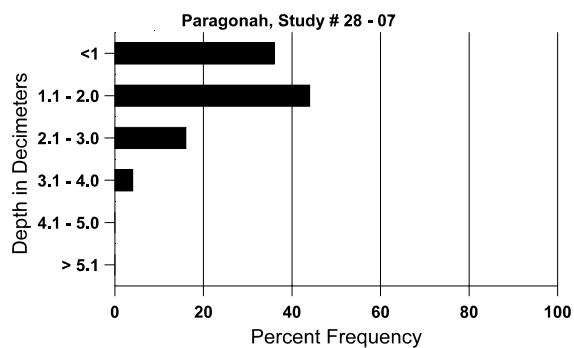
Cover Type	Average Cover %			
	'87	'92	'98	'03
Vegetation	2.75	25.71	35.17	11.72
Rock	12.25	29.99	9.75	7.34
Pavement	27.00	0	18.49	9.14
Litter	43.50	34.60	47.87	57.23
Cryptogams	0	2.03	2.18	1.27
Bare Ground	14.50	24.43	17.53	20.29

# SOIL ANALYSIS DATA --

Management unit 28, Study no: 7, Study Name: Paragonah

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
10.9	68.4 (12.1)	6.3	65.4	20.4	14.2	2.2	6.0	3.2	0.4

## Stoniness Index



PELLET GROUP DATA --

Management unit 28 , Study no: 7

Type	Quadrat Frequency		
	'92	'98	'03
Sheep	2	-	-
Rabbit	84	56	24
Elk	-	1	-
Deer	26	28	4

Days use per acre (ha)	
'98	'03
-	-
-	-
-	-
23 (57)	23 (58)

BROWSE CHARACTERISTICS --

Management unit 28 , Study no: 7

		Age class distribution (plants per acre)					Utilization				
Y	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia nova</i>											
87	<b>3665</b>	333	466	2933	266	-	11	76	7	2	10/18
92	<b>4300</b>	440	840	2200	1260	-	53	22	29	1	-/-
98	<b>2540</b>	100	480	1560	500	260	13	0	20	3	11/21
03	<b>2960</b>	-	140	1560	1260	160	9	4	43	11	9/15
<i>Artemisia tridentata vaseyana</i>											
87	<b>199</b>	66	133	-	66	-	0	100	33	0	-/-
92	<b>280</b>	40	120	100	60	-	21	14	21	0	-/-
98	<b>240</b>	20	60	120	60	40	25	0	25	0	14/26
03	<b>60</b>	-	-	20	40	-	0	33	67	33	22/33
<i>Brickellia spp.</i>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>20</b>	-	-	20	-	-	0	0	-	0	-/-
98	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<i>Chrysothamnus nauseosus</i>											
87	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
92	<b>20</b>	20	20	-	-	-	0	0	-	0	-/-
98	<b>40</b>	-	-	40	-	-	0	0	-	0	8/12
03	<b>0</b>	-	-	-	-	-	0	0	-	0	-/-
<i>Eriogonum microthecum</i>											
87	<b>0</b>	-	-	-	-	-	0	0	0	0	-/-
92	<b>520</b>	20	120	400	-	-	4	8	0	0	-/-
98	<b>140</b>	-	80	40	20	-	0	29	14	29	7/11
03	<b>80</b>	-	-	80	-	-	0	25	0	0	5/6

		Age class distribution (plants per acre)					Utilization				
Y e a r	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Gutierrezia sarothrae</i>											
87	<b>7932</b>	466	400	7266	266	-	0	0	3	3	8/5
92	<b>4320</b>	120	1640	2660	20	-	0	0	0	0	-/-
98	<b>1320</b>	20	400	900	20	40	0	0	2	2	9/9
03	<b>2560</b>	60	420	2120	20	80	0	0	1	.78	6/6
<i>Juniperus osteosperma</i>											
87	<b>0</b>	66	-	-	-	-	0	0	-	0	-/-
92	<b>80</b>	20	-	80	-	-	0	0	-	0	-/-
98	<b>40</b>	-	-	40	-	-	0	0	-	0	-/-
03	<b>0</b>	-	-	-	-	80	0	0	-	0	-/-
<i>Leptodactylon pungens</i>											
87	<b>932</b>	-	66	866	-	-	0	0	0	93	3/5
92	<b>600</b>	-	80	520	-	-	3	0	0	0	-/-
98	<b>360</b>	-	40	300	20	-	0	0	6	0	7/12
03	<b>320</b>	-	60	240	20	-	0	0	6	6	4/7
<i>Opuntia</i> spp.											
87	<b>66</b>	-	-	66	-	-	0	0	0	100	2/8
92	<b>100</b>	20	20	60	20	-	0	0	20	20	-/-
98	<b>60</b>	20	20	20	20	-	0	0	33	67	5/9
03	<b>60</b>	-	-	60	-	-	0	0	0	0	6/11
<i>Pinus edulis</i>											
87	<b>200</b>	-	-	200	-	-	0	0	-	0	85/47
92	<b>400</b>	-	240	160	-	-	0	0	-	0	-/-
98	<b>300</b>	60	80	220	-	20	0	0	-	0	-/-
03	<b>0</b>	80	-	-	-	180	0	0	-	0	-/-
<i>Quercus gambelii</i>											
87	<b>200</b>	-	200	-	-	-	0	0	0	0	-/-
92	<b>2620</b>	400	1860	520	240	-	9	18	9	6	-/-
98	<b>1020</b>	-	640	380	-	80	0	0	0	0	87/29
03	<b>2160</b>	-	740	1340	80	160	0	0	4	2	59/31